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(54) Pump for pumping liquid

(57) A pump for pumping liquid devised for medical or surgical use operates on an Archimedean screw principle and comprises a flexible plastics tube (11) having a flexible central drive cable or rod (15) stretching between its ends. An operative end (12) contains a Archimedean screw pump element (14) having a helix angle between 30° and 45° and centrally positioned by a spider (16). The operative end (12) has a filter mesh (13) and can be used for pumping blood, urine or other body fluids for example. The pump does not produce a vacuum and so avoids suction effect on surrounding tissue and the entrainment of large quantities of air.

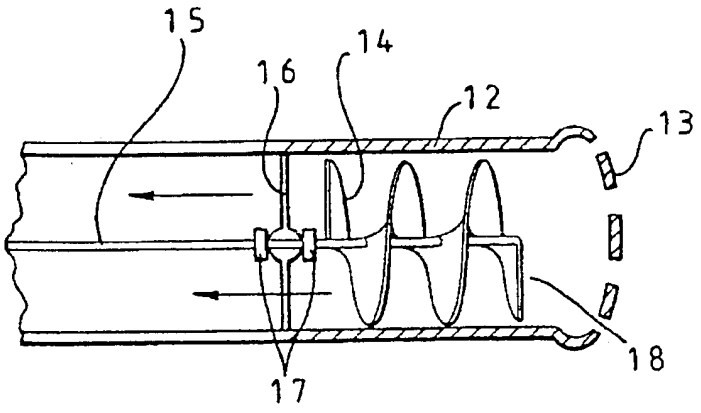

FIG 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

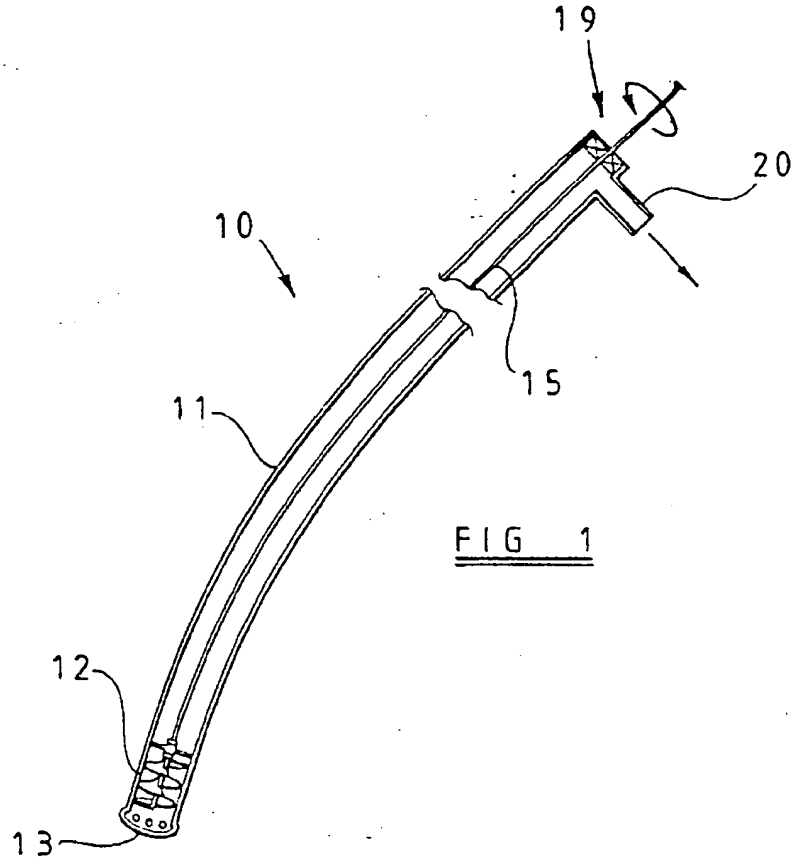

FIG 1

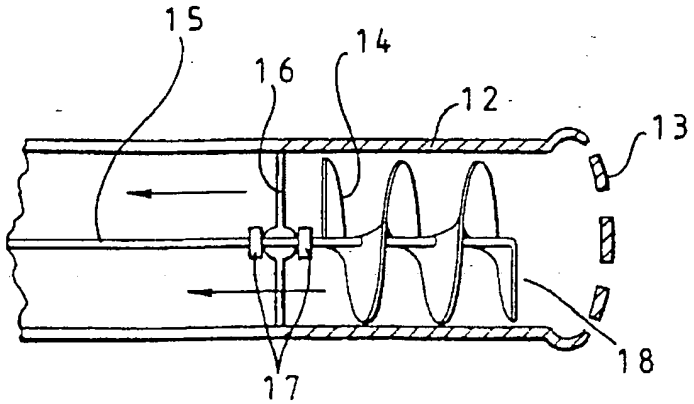

FIG 2

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Title: Pump for Pumping Liquid

This invention relates to a pump for pumping liquid.

It was particularly devised for medical and surgical use but may find application in other fields.

In medicine and surgery there is often a requirement to pump body liquids for example blood, urine or saliva. Conventional aspiration equipment uses a partial vacuum to suck fluid into a tube to a collection vessel.

There are several disadvantages to this method, especially in the medical and surgical context. Firstly, the suction is noisy. When the liquid is partially or completely drained, neighbouring tissue may be sucked against the tube by the vacuum, causing unnecessary damage to such tissue. Air is continuously drawn through a suction aspiration system. In situations where the aspired fluid is reintroduced to the patient, there is a risk of bacteria from the surrounding atmosphere being drawn into the liquid and concentrated by the action of the suction pump.

It is an object of the present invention to provide a pump for pumping liquid which does not rely on the creation of a partial vacuum.

According to the invention there is provided a pump comprising a tube, a helical pump element sized to be a close running fit within the tube, journal means for rotatably mounting the helical pump element at an operative end of the tube, elongate drive means for the helical pump element disposed within the tube and outlet means for liquid.

The tube may be flexible throughout its length except at the operative end.

The helix may have an angle of between 30° and 45°.

The drive means may comprise a Bowden cable or a rotary drive rod.

The outlet means may be laterally disposed at a position between the ends of the flexible tube. The operative end of the tube may have a filter.

The invention will now be described in more detail by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a pump embodying the invention

Figure 2 is an enlarged detail view of the operative end of the pump.

Referring to the drawings, a pump generally indicated at 10 comprises an elongate flexible tube 11 which is made from plastics material. An operative end portion 12 of the pump comprises a rigid plastics tube, shown in more detail in Figure 2.

A grid or mesh 13 covers the operative end.

A helical pump element 14 is mounted concentrically with the operative end 12 of the tube. The pump element 14 has a helix angle of between 30° and 45° and is a close fit within the operative end 12 of the tube.

A drive rod or cable 15 extends generally centrally through

the tube 11 and is supported at the operative end by a spider 16. The drive cable or rod 15 has a pair of location abutments 17, one on each side of the spider, to prevent the helical pump element 14 from moving longitudinally in the tube.

In use, the operative end portion 18 of the pump is placed in an area to be drained and the cable 15 or drive rod is rotated at a variable speed by a suitable motor 19. The motor can be for example a battery operated DC motor or a compressed air drive unit. Liquid pumped on the Archimedean screw principle through the flexible tube 11 is discharged through a discharge opening 20.

The helical pump element 14 is a close fit within the rigid operative end portion 12 of the operative end. The rotation of the helical pump element can provide variable speed pumping of liquid in either direction but, because there is always equality of air pressure at either side of the blades of the helix, since they are not hermetically sealed, gases are not pumped by the apparatus. In other words, if the pump is being used to drain liquid from an area, when the liquid has been exhausted, there is no tendency for large quantities of air to be drawn through the pump. Where the liquid is blood for example, this may reduce air entrainment and hence contamination and deterioration of the blood, which is particularly advantageous if the blood is to be recirculated to the body.

The grid or mesh 13 prevents large solids entering the tube, for example blood clots or portions of tissue.

Since there is no vacuum created, there is no suction effect on surrounding tissues. No air pump is needed to operate the device. The rate of fluid removal is more easily adjustable

than in a conventional evacuation unit.

Peristaltic or roller pumps are frequently used in pumping blood for surgical procedures. However, these are of heavy construction and act by compressing a tube externally, at the risk of crushing the cell structure of the blood being pumped. They have the advantage of being bidirectional.

— However using the pump described, bidirectional pumping at variable rates can readily be achieved without substantial damage to the blood cells and without extensive air entrainment.

Such arrangements may also be used for bedside, peritoneal dialysis systems or continuous ambulatory peritoneal dialysis systems.

Bidirectional pumps of the type described could be provided in a miniaturised version capable of insertion into an artery or vein to facilitate blood withdrawal or infusion in haemodialysis.

Although the applications described above are principally in the field of medicine and surgery, the pump may be applicable in many other contexts. It could be arranged to be operated from a conventional domestic electric drill.

CLAIMS

1. A pump comprising a tube which is at least partly flexible, one end of the tube being an operative end, a helical pump element sized to be close running fit within the tube, journal means rotatably mounting the helical pump element at said operative end of the tube, elongate drive means for the helical pump element disposed within the tube, and outlet means spaced from said operative end of the tube for outlet of liquid pumped thereby.

2. A pump according to claim one wherein the tube is flexible throughout its entire length.

3. A tube according to claim 1 wherein said operative end only of the tube is rigid.

4. A pump according to any preceding claim wherein the helix has an angle of between 30° and 45°.

5. A pump according to any preceding claim wherein the drive means comprise a flexible Bowden cable.

6. A pump according to any one of claims 1-4 wherein the drive means comprise a rotary drive rod.

7. A pump according to any preceding claim wherein said outlet means are laterally disposed at a position between the ends of the tube.

8. A pump according to any preceding claim wherein said operative end of the tube has a filter.

9. A pump according to any preceding claim and made of biologically acceptable synthetic plastics material.

10. A pump substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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